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Amendmentstotheclaims

1. (Previously presented) An inertial sensor comprising an electrodynamic trap for suspending one or more charged particles and a readout device for measuring the inertial forces to which said trap is being subjected by measuring variations in the position or motion of said one or more charged particles when said electrodynamic trap is subjected to acceleration and when said one or more charged particles are subjected to electrodynamic forces applied by said electrodynamic trap, said electrodynamic trap comprising a ring electrode and at least one additional electrode spaced from the plane containing said ring electrode and aligned with the axis of said ring electrode, and a power source for applying an oscillatory electrical potential between said ring electrode and said at least one additional electrode to create a quadrupole field that elastically constrains said one or more charged particles to a specific location between said electrodes by a substantially linear restoring force.

2. (Previously presented) An inertial sensor as set forth in claim 1 wherein said readout device comprises a light source directed at said one or more charged particles and means for measuring the spectral characteristics of the variations in the intensity of light scattered by said one or more of ~~said~~ charged particles.

3. (Previously presented) An inertial sensor as set forth in claim 2 wherein said light source includes focusing means for concentrating light on said one or more <u>charged</u> particles.

Claims 4-5. (Canceled)

6. (Original) An inertial sensor as set forth in claim 1 wherein said readout device measures variations in the position or motion of said one or more charged particles by optical interferometry.

7. (Original) An inertial sensor as set forth in claim 1 wherein said readout device measures variations in the position or motion of said one or more charged particles by optical leverage.

8. (Original) An inertial sensor as set forth in claim 1 wherein said one or more particles are suspended within an electric field and wherein said readout device measures variations in the position or motion of said one or more charged particles by detecting changes in said field.

9. (Previously presented) An inertial sensor as set forth in claim 8 wherein said changes in said field result from field absorption by said one or more charged particles.

10. (Previously presented) An inertial sensor comprising an electrodynamic trap for suspending one or more particles and a readout device for measuring variations in the position or motion of said one or more charged particles when said electrodynamic trap is subjected to acceleration wherein said readout device measures variations in the position or motion of said one or more charged particles by producing data representing an image of said particles and processing said image data.

11. (Previously presented) An inertial sensor as set forth in claim 10 wherein said readout device comprises a source of illumination directed toward said one or more charged particles, means for projecting an image of said particles as illuminated on an image sensing array to produce said data representing said image, means for digitizing said data, and a data processor for processing said image data to produce output data indicative of a measure of said acceleration.

12. (Previously presented) An inertial sensor as set forth in claim 10 wherein the motion of said one or more charged particles is manifested in said image as one or more corresponding streaks.

13. (Previously presented) An inertial sensor as set forth in claim 10 wherein said readout device includes means directing stroboscopic illumination onto said one or more charged particles to obtain image data providing timed position information on said one or more charged particles.

14. (Previously presented) An inertial sensor as set forth in claim 10 wherein said electrodynamic trap comprises electrodes to which a time-varying potential are applied to suspend said one or more charged particles in a quadrupole field subjecting said one or more charged particles to said electrodynamic forces that balance said one or more particles in stable equilibria against said inertial forces while the position or motion of said one or more charged particles is measured by said readout means.

15. (Previously presented) An inertial sensor as set forth in claim 14 wherein said electrodes comprise a ring electrode and at least one additional electrode spaced from the plane containing said ring electrode and aligned with the axis of said ring electrode to which an oscillatory electrical potential is applied.

16. (Previously presented) An inertial sensor as set forth in claim 14 wherein more than one charged particle are suspended in said trap and wherein said readout means detects variations in the relative positions occupied by different ones of said charged particles.

17. (Previously presented) An inertial sensor as set forth in claim 15 wherein said quadrupole field elastically constrains said one or more charged particles to a specific location between said electrodes by a substantially linear restoring force.

18. (Previously presented) An inertial sensor as set forth in claim 17 wherein said trap further includes means for varying the effective spring constant of said substantially linear restoring force to adjust the sensitivity of said inertial sensor.

19. (Original) An inertial sensor as set forth in claim 18 wherein said at least one additional electrode comprises a pair of end cap electrodes on opposing sides of said ring.

20. (Original) An inertial sensor as set forth in claim 19 wherein said end cap electrodes are hyperboloids.

21. (Original) An inertial sensor as set forth in claim 19 wherein said end cap electrodes are spherical.

22. (Original) An inertial sensor as set forth in claim 19 wherein said end cap electrodes are ring-shaped.

23. (Original) An inertial sensor as set forth in claim 18 wherein said at least one additional electrode comprises a second ring electrode.

24. (Original) An inertial sensor as set forth in claim 18 wherein said at least one additional electrode comprises a planar electrode positioned parallel to the plane of and spaced from said ring electrode.

25. (Previously presented) An inertial sensor as set forth in claim 17 wherein said electrodynamic trap further includes means for varying the magnitude or the frequency of said oscillatory electrical potential to vary said effective spring constant of said substantially linear restoring force.

26. (Previously presented) An inertial sensor as set forth in claim 14 wherein said one or more charged particles are constrained to a specific location between said electrodes at which said one or more charged particles are in stable equilibrium by a restoring force produced by said time-varying potential .

27. (Previously presented) An inertial sensor as set forth in claim 26 wherein said readout device includes means for measuring the intensity of light scattered from said one or more charged particles.

28. (Previously presented) An inertial sensor as set forth in claim 26 wherein said readout device measures variations in the position or motion of said one or more charged particles by producing data representing an image of said particles and processing said image data.

29. (Previously presented) An inertial sensor as set forth in claim 26 wherein said readout device measures variations in the position or motion of said one or more charged particles by optical interferometry.

30. (Previously presented) An inertial sensor as set forth in claim 10 wherein said one or more charged particles have a known mass and charge at the time said readout device measures said variations.

31. (Previously presented) An inertial sensor as set forth in claim 30 wherein said one or more charged particles are ions.

32. (Previously presented) An inertial sensor as set forth in claim 30 wherein said one or more charged particles are naturally monoisotropic ions.

33. (Previously presented) An inertial sensor as set forth in claim 30 wherein said sensor includes means for adding a charge to said one or more charged particles prior to measuring said variations.

34. (Previously presented) An inertial sensor as set forth in claim 33 wherein said one or more charged particles are conductive spheres.

35. ((Previously presented) An inertial sensor as set forth in claim 10 wherein said readout means detects displacements in the center of mass of said one or more charged particles caused by said acceleration.

36. (Previously presented) An inertial sensor as set forth in claim 10 wherein said readout means detects an increase in the micromotion of said one or more charged particles caused by said acceleration.

37. (Previously presented) An inertial sensor as set forth in claim 10 wherein said one or more charged particles occupy an asymmetrical orbit and wherein said readout means detects variations in the orientation of said asymmetrical orbit occupied by said one or more charged particles.

38. (Previously presented) An inertial sensor comprising an electrodynamic trap for suspending one or more particles and a readout device for measuring variations in the position or motion of said one or more charged particles when said electrodynamic trap is subjected to acceleration wherein more than one charged particle are suspended in said trap and wherein said readout means detects variations in the relative positions occupied by different ones of said charged particles.

39. (Previously presented) An inertial sensor as set forth in claim 38 wherein said trap further includes means for damping the motion of said charged particles within said trap.

40. (Previously presented) An inertial sensor as set forth in claim 39 wherein said means for damping includes a fluid medium within which said charged particles are suspended.

41. (Previously presented) An inertial sensor as set forth in claim 39 wherein said readout device measures the amount of rotational acceleration causing said variations in the relative positions occupied by different ones of said charged particles.

42. (Canceled)

43. (Original) An inertial sensor as set forth in claim 14 wherein said electrodes are formed from conductive planar layers separated by insulating layers.

44. (Original) An inertial sensor as set forth in claim 14 wherein said electrodes are formed from the conductive layers in a printed circuit board.